

J.R.Schrieffer, 1964, Theory of Superconductivity

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第 1 章

Introduction

1.1 Simple Experimental Facts

1.2 Phenomenological Theories

1.2.1 Gorter-Casimir Model

(1-6).

$$\begin{aligned}\frac{\partial F}{\partial x} &= \frac{1}{2} \frac{1}{\sqrt{x}} \left(-\frac{1}{2} \gamma T^2 \right) - 1(-\beta) = 0 \\ \frac{\gamma T^2}{4} \frac{1}{\sqrt{x}} &= \beta \\ \therefore \sqrt{x} &= \frac{\gamma T^2}{4\beta} \\ \therefore x &= \underbrace{\left(\frac{\gamma}{4\beta} \right)^2 T^4}\end{aligned}$$

(1-8).

$$\begin{aligned}H_c^2(T) &= 8\pi(F_n(T) - F_s(T)) = 8\pi(F(1, T) - F(0, T)) \\ &= 8\pi(f_n(T) - f_s(T)) = 8\pi\left(-\frac{1}{2}\gamma T^2 + \beta\right) \\ &= 8\pi\beta\left(1 - \frac{\gamma}{2\beta}T^2\right) \equiv \underbrace{H_0\left(1 - \left(\frac{T}{T_c}\right)^2\right)}\end{aligned}$$

(1-9).

$$\begin{aligned}
C_{es}(T) &= -T \left(\frac{\partial^2 F}{\partial T^2} \right) = -T \sqrt{x} (-\gamma) = \gamma T \sqrt{x} \\
&= \gamma T_c \left(\frac{T}{T_c} \right)^3 \quad \because \text{Eq.(1-6)} \\
&\quad \underbrace{\hspace{1.5cm}}
\end{aligned}$$

1.2.2 The London Theory

1.2.3 F.London's Justification of the London Theory

1.2.4 Pippard's Nonlocal Generalization of the London Theory

1.2.5 Ginsburg-Landau Theory

(1-43).

$$\begin{aligned}
f(T) &= a \left(-\frac{a}{b} \right) + \frac{1}{2} b \left(-\frac{a}{b} \right)^2 \\
&= -\frac{a^2}{b} + \frac{a^2}{2b} = -\frac{a^2(T)}{\underbrace{2b(T)}}
\end{aligned}$$

(1-44).

$$\begin{aligned}
\frac{\lambda^2(0)}{\lambda^2(T)} &= \frac{n_s^2(T)}{n_s^2(0)} = \frac{|\Psi_e(T)|^2}{|\Psi_e(0)|^2} \quad \because \text{Eq.(1-38)} \\
&= |\Psi_e(T)|^2 \quad \because n = n_s \quad \text{for } T = 0 \\
&\therefore \underbrace{|\Psi_e(0)| = 1}
\end{aligned}$$

(1-48).

$$\begin{aligned}
\frac{\partial f}{\partial \Psi(\mathbf{r})} &= 0 \\
\Rightarrow 0 &= -\frac{\hbar^2}{2m^*} \left(\nabla + \frac{ie^*}{\hbar c} A(\mathbf{r}) \right) 2\Psi(\mathbf{r}) \\
0 &= -\frac{H_c^2(T)}{4\pi m^*} \frac{\lambda^2(T)}{\lambda^2(0)} \left(1 - \frac{\lambda^2(T)}{\lambda^2(0)} |\Psi(\mathbf{r})|^2 \right) 2\Psi(\mathbf{r}) \\
&\therefore \underbrace{\text{Eq.(1-48)}}
\end{aligned}$$

(1-51).

(1-52).

第 2 章

The Pairing Theory of Superconductivity

- 2.1 Physical Nature of the Superconducting State
- 2.2 The One-Pair Problem
- 2.3 Landau's Theory of a Fermi Liquid
- 2.4 The Pairing Approximation
- 2.5 Quasi-Particle Excitations
- 2.6 Linearized Equations of Motion

参考文献

- [1] J.R.Schrieffer. 1964. Theory of Superconductivity [Revised Printing]. <http://zimp.zju.edu.cn/~qchen/Teaching/AdvStat/Schrieffer.pdf>